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# A taxonomic update of *Conostephium* (Ericaceae: Styphelioideae: Styphelieae)

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## Abstract

Hislop, M. A taxonomic update of *Conostephium* (Ericaceae: Styphelioideae: Styphelieae). *Nuytsia* 23: 313–335. Four new species from the Western Australian endemic genus *Conostephium* Benth., *C. hortiorum* Hislop, *C. laeve* Hislop, *C. papillosum* Hislop and *C. prolatum* Hislop are described, illustrated and their distributions mapped. Among these, *C. prolatum* has a very restricted distribution and is a conservation priority. A key to the 11 recognised species is provided as well as one to distinguish between the two putative generic taxa in the *Conostephium* clade. Lectotypes are designated for *C. pendulum* Benth., *C. preissii* Sond. and for the genus *Conostephiopsis* Stschegl. Taxonomic notes pertaining to *C. drummondii* (Stschegl.) C.A.Gardner, *C. pendulum*, *C. preissii* and *C. roei* Benth. are also included.

## Introduction

*Conostephium* Benth. is a small, endemic Western Australian genus first described by Bentham (1837) to accommodate the single species, *C. pendulum* Benth. Within a decade another two had been added, *C. minus* Lindl. (Lindley 1839) and *C. preissii* Sond. (Sonder 1845). The Russian taxonomist Serge Stschegleew (1859) then described a second, similar genus, *Conostephiopsis* Stschegl., in which he placed a new species, *C. drummondii* Stschegl. At the same time he transferred *C. minus* and *C. preissii* to the new genus, so rendering *Conostephium* once again monotypic. This arrangement however was short-lived because in his treatment for *Flora Australiensis*, Bentham (1868) synonymised *Conostephiopsis* under *Conostephium*, while adding a fourth species, *C. roei* Benth. The morphological basis for the recognition of *Conostephiopsis* as a separate genus depended in large part on the presence in *Conostephium pendulum* of a nectary and five hair tufts towards the base of the internal corolla tube (or conversely their absence in *Conostephiopsis*). The reason that Bentham rejected *Conostephiopsis* may well lie in the fact that his new species, *C. roei*, combined the presence of an obvious nectary with an absence of hair tufts, so eroding the already slight differences between the two genera. After *Flora Australiensis* there was an interval of well over a hundred years before a further three species were described in separate publications, *C. marchantiorum* Strid (Strid 1986), *C. uncinatum* Moezel (van der Moezel 1987) and *C. magnum* Cranfield (Cranfield 2002).

In their investigation into the molecular phylogeny of the tribe *Styphelieae* Bartl., Quinn *et al*. (2003) presented cladistic analyses of DNA data which indicated that *Conostephium* was sister to the species-pair *Astroloma pinifolium* (R.Br.) Benth. and *A. conostephioides* (Sond.) Benth. Together they formed a well-supported lineage which the authors referred to as the *Conostephium* clade. This represented


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corroboration of earlier research (i.e. Powell *et al*. 1997; Streiber 1999) which strongly suggested that *A. pinifolium* and *A. conostephioides* could not be regarded as being congeneric with *Astroloma* R.Br. *s. str*. Brown (1810) had originally described *Stenanthera* R.Br. to accommodate *A. pinifolium*, and although later synonymised under *Astroloma* by Bentham (1868), it is clear that that genus will need to be reinstated. Recently, several geographically restricted Western Australian taxa apparently with close affinities to *A. conostephioides* have also come to light, one of which has already been described as *C. pungens* Keighery (Keighery 2002). Unpublished molecular data (C. Puente-Lelièvre pers. comm.) has confirmed that these are closely related to the eastern species-pair and will therefore also come to be recognised as species of *Stenanthera*. Pending the formal reinstatement of this genus it is referred to as the '*Astroloma conostephioides* group' in the key below. The question of whether the recognition of both *Conostephium* and *Stenanthera* represents the optimum taxonomic resolution for the clade is best addressed after more species of *Conostephium* have been sampled. At this stage the tenability of maintaining two genera is at least not contradicted by the limited molecular phylogeny available, and the morphological grounds for the retention of *Conostephium* appear strong. The current paper updates the taxonomy of this distinctive Western Australian genus and adds four new species, bringing the total number of recognised species to 11.

## Methods

This study was based on an examination of dried specimens housed at PERTH and supported by field observations of all species in the genus apart from *C. hortiorum* Hislop.

Foliar measurements were taken from dried specimens in natural posture. Leaf thickness was measured at the midrib, half way along the lamina. Observations of leaf venation were made from mature leaves only. Across the tribe *Styphelieae* generally it is common for young leaves to show prominently raised venation on the abaxial surface which is much less evident, if at all, at maturity. Similarly, the first leaves produced at the beginning of a growth flush should be ignored. The lowest of these are clearly bract-like, but there is a morphological transition across several nodes before the form of the mature leaves is reached. Floral measurements were taken from rehydrated flowers in natural posture. This includes sepal, bracteole and bract width which are, in consequence, significantly narrower than would be the case if they were flattened out before measurement. This method was preferred because the curvature can be so extreme in these organs that they are inclined to either split or become pleated when attempts are made to flatten them. Inflorescence axis length and the number of bracts on the axis are useful diagnostic characters in the recognition of several species of *Conostephium*, and it is important that the axis length be measured in a consistent way. Care should be exercised when removing the axis from the leaf axil so as to include any basal bracts. The rehydrated flower should be detached from the axis by holding it firmly between the finger and thumb and then applying light pressure to the upper axis with the blunt edge of a scalpel until they separate. The separation point obtained in this way corresponds to a natural line of abscission observed after mature fruit have been shed. When this method has been followed, the upper two or three axis bracts will be seen to be significantly larger than those below. Note that if the inflorescence axis is measured *in situ* the length recorded is likely to be significantly less than that obtained by following this method. Bracts inserted on the floral axis below the bracteoles are referred to here as floral bracts. Depending on the species these may vary in number between zero and at least nine. Measurement of the filament length includes the free portion of the connective.

The distribution map was compiled using DIVA-GIS Version 5.2.0.2 and based on PERTH specimen data.

## Taxonomy

**Conostephium** Benth. in S.F.L.Endlicher, E.Fenzl, G.Bentham, & H.W.Schott, *Enum. Pl.*: 76 (1837).

*Type*: *Conostephium pendulum* Benth.

*Conostephiopsis* Stschegl., *Bull. Soc. Imp. Naturalistes Moscou* 32 (1): 5 (1859). *Lecto*: *Conostephiopsis drummondii* Stschegl., here designated.

Erect *shrubs*, usually robust and long-lived, sometimes with a fire-resistant rootstock. *Leaves* helically arranged; apex acute and mucronate or obtuse and with a blunt callus tip, sometimes coarsely pungent; margins entire, glabrous to ciliate. *Inflorescence* axillary, usually pendulous or sub-pendulous, occasionally widely spreading, 1- or very occasionally 2-flowered; the axis with numerous bracts increasing in size towards the apex, terminating in a flower, no bud rudiment present. *Flowers* subtended by an undifferentiated series of closely imbricate floral bracts, bracteoles and sepals, spirally arranged on an elongate axis. *Floral bracts*, *bracteoles* and *sepals* usually with prominent venation, often striate, the texture varying from thickened and indurate to thin and ± scarious, rounded abaxially. *Corolla* either deciduous soon after anthesis, or persistent to, or close to, fruit maturity. *Corolla tube* pink or purple on the exposed, upper portion, cream or white on the concealed portion below (in some species this lower portion becomes exposed in late flower), ± actinomorphic to manifestly zygomorphic, ± fusiform, narrowly conical or sometimes cylindrical over most of its length, but always tapering in the upper portion towards the lobes, many times longer than the lobes; external surface glabrous or appressed-hairy, smooth, faintly rugose, tuberculate or papillate; internal surface usually hairy from the top of the tube at least to the anther bases (very occasionally the uppermost portion of the tube is glabrous) with an indumentum of retrorse and antrorse hairs which is ± appressed behind the anthers, the basal portion glabrous, sparsely hairy or with 5 well-defined hair tufts arising from unmodified tissue. *Corolla lobes* pink, yellow or white, very short, erect to ± spreading; external surface glabrous; internal surface glabrous or sparsely hairy. *Anthers* bifid, included within the corolla tube. *Filaments* distinctly flattened (linear in section), or less often compressed only (narrowly elliptic in section), glabrous or hairy, attached 1/4–1/2 above the anther base, adnate to the tube either close to the base or near the middle (may be a little above or below), sometimes with an abruptly and prominently thickened anther connective. *Ovary* glabrous or variously hairy, 2–5-locular. *Style* glabrous or hairy in the lower 1/2–2/3, exserted from tube (except when the flower first opens); *stigma* not enlarged; nectary very reduced or apparently absent, when present annular, entire or shallowly lobed, glabrous. *Fruit* mesocarp well-developed at maturity with the surface reticulate or conspicuously rugose on dried specimens, shorter than and enclosed by the sepals; style either deciduous or long-persistent within the attached corolla tube.

### Pollination in *Conostephium*

Recent research by Houston and Ladd (2002) has provided confirmation of a buzz-pollination syndrome for the genus *Conostephium*. In the course of their studies several species of native bee from the genera *Leioproctus* F.Smith and *Lasioglossum* Curtis were observed 'sonicating' flowers of four species of *Conostephium* (*C. pendulum*, *C. minus*, *C. drummondii* (Stschegl.) C.A.Gardner and *C. laeve* Hislop, the latter incorrectly identified in the study as *C. roei*). Sonication is a process by which flying insects grasp parts of the flower from below (usually the anthers themselves but in the case of *Conostephium* the corolla tip) and rapidly vibrate their wing muscles in order to release pollen. In flowers adapted to this form of pollination the reward for the visiting insect is the pollen itself and nectar may not be

present. The fact that Houston and Ladd were unable to detect nectar in the flowers of *C. pendulum*, which has the best-developed nectaries in the genus, suggests that it is unlikely to be present in any of the species. The following morphological features of the genus are consistent with adaptations for buzz-pollination: usually pendulous or sub-pendulous flowers, tapered upper corolla tube with a very narrow orifice, the presence of apparently pollen-trapping hairs on the inner corolla tube adjacent to the anthers and a poorly developed or apparently absent nectary. An important field observation made during the course of Houston and Ladd's study is that in species of *Conostephium* the corolla and style elongate through the flowering period. When the flowers first open only the short corolla lobes are visible beyond the sepals at which stage they are very easily overlooked. Gradually over several days the tube and style elongate to their maximum length. Floral elongation of this kind is not known to occur elsewhere in the tribe *Styphelieae* and is a probable autapomorphy for the genus. An obvious implication of this finding is that corolla tube and style length, generally important taxonomic characters across the tribe, must be treated with considerable circumspection when assessing their potential to discriminate taxa in *Conostephium*.

One other genus in the tribe *Styphelieae*, *Coleanthera* Stschegl., has flowers that are known to be buzz-pollinated (Keighery 1996). As in most *Conostephium*, in the three species of *Coleanthera* the nectary is apparently absent or at least vestigial. However, whereas in *Conostephium* the entire corolla tip is sonicated by visiting bees, in *Coleanthera* it is the exserted connate anthers that are grasped—this being the most common form of sonication.

### Key to putative genera in the *Conostephium* clade (*sensu* Quinn *et al.* 2003)

**1.** Exposed portion of corolla tube pink or purple, corolla lobes pink, white or yellow, to *c.* 2.5 mm long and 0.8 mm wide, but usually much less, external surface glabrous, internal surface glabrous or sparsely and inconspicuously hairy; upper corolla tube tapering markedly towards the lobes; hairs on internal corolla surfaces smooth; hair tufts usually absent from base of corolla tube, but if present then issuing from unmodified tissue; anthers included within corolla tube, filaments adnate to the tube close to the middle or near the base (WA)............ **Conostephium**

**1:** Exposed portion of corolla tube and lobes red in most species (in *A. pinifolium* the tube mostly yellow or a combination of yellow and red or green and the lobes green), the lobes larger than in *Conostephium*, external surface hairy in most species (hairy or papillate only towards the tips in *A. pinifolium*), internal surface clearly hairy, although the hairs not evenly distributed; upper corolla tube ± cylindrical or expanding towards the lobes; hairs on internal corolla surfaces ornamented; base of corolla tube usually with hair tufts issuing from fleshy appendages (these absent in *A. pinifolium*); anthers fully or partially exserted from corolla tube, filaments adnate to the top of the tube (WA; NSW; SA; Tas.; Vic.)............ **Astroloma conostephioides group**

### Key to species of *Conostephium*

**1.** Ovary hairy in the upper half, or occasionally throughout

**2**. Exposed portion of corolla tube pink; filaments inserted close to base of corolla tube; occurring north of Geraldton (Binnu–Zuytdorp N.R. with an apparent outlier at East Yuna N.R.)............ **C. laeve**

**2:** Exposed portion of corolla tube purple; filaments inserted at *c.* the middle of corolla tube, a little above or a little below; occurring south of Geraldton

**3.** Outer surface of corolla tube smooth or faintly rugose in upper half, exposed portion glabrous

**4.** Inflorescence axis length 2.1–3.4 mm long; longest sepals 5.6–7.2 mm long; corolla lobes 0.3–1.0 mm long (Serpentine–Regans Ford area with an outlier near Collie)............. **C. minus**[1]

**4:** Inflorescence axis length 3.0–5.2 mm long; longest sepals 8.0–10.2 mm long; corolla lobes 0.9–2.2 mm long (Cataby area–Eneabba) .................................................**C. magnum**[1]

**3:** Outer surface of corolla tube papillose in upper half, exposed portion glabrous or hairy, sometimes the hairs so dense as to obscure the papillae

**5.** Leaves mostly adaxially concave or flat, occasionally some leaves adaxially convex (widespread from the Pingrup area and Fitzgerald River N.P. E to Eyre & N as far as the Forrestania area) ............................................................................ **C. drummondii**

**5:** Leaves mostly adaxially convex, with the margins recurved to revolute, occasionally some leaves flat

**6.** Leaves glabrous, except sometimes for the presence of very short hairs within the abaxial grooves; exposed portion of corolla tube glabrous, obviously papillose (Grass Patch area–Israelite Bay) ................................................ **C. papillosum**

**6:** Abaxial surface of leaves with conspicuous, long hairs, adaxial surface hairy or not; exposed portion of corolla tube densely hairy, the hairs obscuring the papillae

**7.** Leaf tips usually ± straight or somewhat deflexed (up to *c.* 40°), most, or at least some leaves wider than 1.1 mm, abaxial surface of most, or at least some leaves clearly visible between the recurved margins; indumentum of bracteoles and sepals widely spreading (Cascades–Scaddan area)................................... **C. marchantiorum**

**7:** Leaf tips prominently deflexed (from *c.* 70°–170°), leaves 0.8–1.1 mm wide, abaxial surface usually concealed by abutting leaf margins; indumentum of bracteoles and sepals appressed or rarely slightly spreading (Grass Patch & Salmon Gums E to the Clyde Hill area) ...................................................................**C. uncinatum**

**1:** Ovary glabrous, or occasionally with a few hairs about the style base

**8.** Outer surface of corolla tube tuberculate or papillose in the upper half, although the surface may be partially obscured by an appressed indumentum

**9.** Abaxial surface of leaves ± smooth or striate with shallow grooves between the veins; margins of sepals glabrous or minutely ciliolate about the apex; filaments inserted close to the base of the corolla tube (mainly coastal plain from N of Eneabba–Harvey area but with sporadic occurrences extending well inland in the vicinity of salt lakes) ..................................................................................**C. preissii**

**9:** Abaxial surface of leaves deeply and narrowly grooved between the broad veins; margins of sepals manifestly ciliate throughout; filaments inserted at *c.* the middle of corolla tube, a little above or a little below (Grass Patch area–Israelite Bay) ..................................................................................... **C. papillosum**

**8:** Outer surface of corolla tube smooth or faintly rugose in the upper half

**10.** Exposed portion of corolla tube pink; filaments inserted close to the base of the corolla tube; leaves usually adaxially concave or flat, occasionally adaxially convex (Binnu–Zuytdorp N.R. with an apparent outlier at East Yuna N.R.) ............................................................................................................ **C. laeve**

**10:** Exposed portion of corolla tube dark purple; filaments inserted at *c.* the middle of corolla tube, a little above or a little below; leaves adaxially convex, the margins usually manifestly recurved or revolute, occasionally ± flat

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1 — There are no qualitative differences between *C. magnum* and *C. minus*. Although the measurements used in the key will separate the two in most cases there are a few collections (e.g. *E.A. Griffin* 5192) that could as well be referred to one species as the other.

**11.** Internal corolla tube with 5 ± discrete hair tufts close to the base; inflorescence axis 5.4–10.2 mm long (Eneabba–Margaret River).................................**C. pendulum**

**11:** Internal corolla tube lacking hair tufts; inflorescence axis to 5.2 mm long, usually <5 mm

**12.** Leaves 4.5–9.5 mm long; leaf mucros 0.2–0.3 mm long; inflorescence axis 0.9–2.0 mm long; fruiting endocarp longitudinally ridged (Ongerup–Newdegate–Lake Magenta area)...................................................................... **C. roei**

**12:** Leaves at least 10 mm long; leaf mucros at least 0.5 mm long; inflorescence axis at least 2.3 mm long; fruiting endocarp ± smooth

**13.** Branchlet indumentum very short, uniform in length, to *c.* 0.1 mm long; leaves narrowly obovate, narrowly obtriangular or occasionally linear, abaxial surface appearing glabrous, but usually with very short, sparse hairs in the grooves; sepals 4.8–7.5 mm long; corolla lobes 0.4–0.6 mm long (Fitzgerald River N.P.)............................................ **C. prolatum**

**13:** Branchlet indumentum of mixed lengths, the longer hairs from 0.5–1.2 mm long; leaves linear, very narrowly triangular or very narrowly elliptic, abaxial surface manifestly hairy; sepals 8.5–10.8 mm long; corolla lobes 1.2–2.4 mm long (eastern Darling Ra.)............................................. **C. hortiorum**

## Descriptions

**Conostephium hortiorum** Hislop, *sp. nov.*

*Typus*: Wandoo National Park, Flynn Block, Catchment Road, York, *c.* 1 km west-south from Talbot West Road, Western Australia, 13 August 2005, *F. & J. Hort* 2560 (*holo*: PERTH 07197497; *iso*: CANB, K, MEL, NSW).

Spreading *shrubs* to *c.* 1.2 m high and 1.5 m wide, but usually smaller, multi-stemmed at ground level with a fire-resistant rootstock. Young *branchlets* with a moderately dense indumentum of ± patent, straight to distinctly curved hairs of mixed lengths, the longest to *c.* 1.2 mm long, these often concentrated about the nodes. *Leaves* antrorse, usually steeply so, linear, very narrowly triangular or very narrowly elliptic, 14–25 mm long, 0.8–3.6 mm wide; apex long-mucronate, the mucro 0.8–1.3 mm long, straight or slightly deflexed, dark brown or black, ± pungent but rather brittle; base cuneate or attenuate; petiole moderately well-defined, cream-coloured, 0.7–1.4 mm long, either sparsely hairy throughout or the abaxial surface glabrous; lamina 0.20–0.35 thick, adaxially convex, the margins varying from slightly recurved to revolute, longitudinal axis straight; surfaces distinctly discolorous; adaxial surface shiny, glabrous, or occasionally sparsely hairy, venation either not evident or manifesting as a few sunken lines; abaxial surface paler with 7–11 raised, primary veins and narrow grooves between, the midrib not differentiated, hairy throughout, frequently with a mixed indumentum of short and longer hairs; margins usually ciliate with hairs to *c.* 0.5 mm long, although these often obscured by the revolute margins, occasionally ± glabrous. *Inflorescence* pendulous or sub-pendulous; axis 2.8–5.2 mm long, hairy, in large part obscured by imbricate bracts. *Axis bracts* 7–9, grading upwards from depressed-ovate to broadly ovate, the two uppermost, 2.2–3.8 mm long, 2.1–3.0 mm wide. *Floral bracts* 3–6, broadly ovate to ovate, 4.0–6.8 mm long, 2.5–4.2 mm wide, obtuse, mucronate, usually coloured dark purple towards the apex. *Bracteoles* ovate or ovate-elliptic, 6.8–8.6 mm long, 3.4–4.4 mm wide, obtuse, mucronate; abaxial surface hairy with a sparse or moderately dense indumentum of short hairs, sometimes ± glabrous, mostly straw-coloured but usually becoming dark purple towards the apex, multi-veined and striate, becoming scarious towards the margins; adaxial surface glabrous; margins

ciliate. *Sepals* ovate to narrowly ovate, 8.5–10.8 mm long, 2.5–4.3 mm wide, the apices grading from obtuse and mucronate in the outer sepals to acute or acuminate in the inner; abaxial surface hairy with a sparse or moderately dense indumentum of short hairs, sometimes ± glabrous, straw-coloured, the outer often dark purple towards the apex, multi-veined and striate, becoming scarious towards the margins; adaxial surface glabrous or with a very few hairs towards the apex; margins ciliate with hairs to 0.3 mm long. *Corolla tube* ± actinomorphic, or very slightly zygomorphic, essentially fusiform, with the widest part at or a little above the middle, 9.5–12.8 mm long, 2.8–3.8 mm wide, exposed portion dark purple, shed soon after anthesis; external surface either glabrous throughout or with a few appressed hairs in the upper half, occasionally the hairs ± dense, smooth, or faintly rugose in the upper half; internal surface densely hairy from the orifice to the base of the bulge, the indumentum a mixture of antrorse and retrorse hairs, usually glabrous in the lower half below the bulge, occasionally sparse hairs extending to *c.* half way between the bulge and the base. *Corolla lobes* erect to ± spreading, white, 1.2–2.4 mm long, 0.45–0.75 mm wide at base, internal surface moderately antrorse-hairy at least in the lower half, the hairs often visible at the connivent bases of adjoining lobes. *Anthers* 3.8–5.6 mm long, the lobes 1/3–1/2 the length of the anthers. *Filaments* 1.4–2.3 mm long, 0.5–0.6 mm wide, distinctly flattened, usually hairy below the connective, occasionally glabrous, the connective abruptly and prominently thickened, dark brown, attached 1/3–1/2 above anther base, adnate to tube at the middle or a little above. *Ovary* ovoid to ellipsoid, 1.3–1.5 mm long, 1.0–1.4 mm wide, glabrous, (4)5-locular. *Style* 9.8–13.8 mm long, glabrous; *nectary* annular, with a jagged, irregular margin, 0.15–0.25 mm long. *Fruit* ovoid, *c.* 7.5 mm long and 6 mm wide (refer comment under *Notes* below), apex obtuse, the surface prominently rugose; endocarp ± smooth. (Figures 1, 2)

*Diagnostic characters*. *Conostephium hortiorum* can be distinguished from related species by the following character combination: branchlet indumentum of mixed lengths, the longest hairs 0.5–1.2 mm long; relatively long, narrow leaves, 14–25 mm long, 0.8–3.6 mm wide with ciliate margins; inflorescence axes 2.8–5.2 mm long; corolla lobes 1.2–2.4 mm long; internal corolla tube lacking hair tufts towards the base.

*Other specimens examined*. WESTERN AUSTRALIA: site 14, Deefor Rd, 3 km SSW [of] Coolakin Spring, 11 Nov. 1996, *M.G. Allen* 524 (PERTH); site 15, off Talbot West Rd, 3.2 km S of Mt Talbot, 12 Nov. 1996, *M.G. Allen* 641 (PERTH); side of West Talbot Rd [WSW of York], 6 Mar. 1997, *R. Davis* 2762 (PERTH); Catchment Rd, Gunapin Forest Block, York, 2.7 km SE of Qualen Rd, 11 Sep. 1999, *F. Hort*, *J. Hort* & *L.W. Sage* 597 (NSW, PERTH); Crawler Rd, Flynn State Forest, York, 0.6 km W of Kent Rd, 6 Sep. 2001, *F. Hort* 1423 (CANB, PERTH); Wandoo National Park, Flynn and Talbot Blocks, Talbot West Rd, York; both sides of the road from 1.3 km SE of Beekeeper Rd to Catchment Rd, 19 Aug. 2005, *F. & J. Hort* 2574 (CANB, PERTH); Wandoo National Park, Flynn Block, Kent Rd, York, off the NW corner of Flynn Plot 2 – 0.75 km S of Talbot West Rd, 19 Aug. 2005, *F. & J. Hort* 2575 (PERTH); Wandoo National Park, Flynn Block, Kent Rd, York; 0.6 km N of Crawler Rd, 19 Aug. 2005, *F. & J. Hort* 2576 (PERTH); Wandoo National Park, Flynn State Forest, Crawler Rd, York, from 0.5–1.6 km W of Kent Rd, 19 Aug. 2005, *F. & J. Hort* 2577 (PERTH); Wandoo National Park, Flynn Block, Deefor Rd, York, 0.5 km W of Kent Rd, 19 Aug. 2005, *F. & J. Hort* 2578 (CANB, PERTH); Wandoo National Park, Flynn Block, Kent Rd York, 2.1 km S of Deefor Rd, 19 Aug. 2005, *F. & J. Hort* 2580 (PERTH); Wandoo National Park, Gunapin Block, Warrigal Rd, York, 200 m W of Kent Rd, S side of road, 19 Aug. 2005, *F. & J. Hort* 2581 (PERTH); Wandoo National Park, Gunapin Block, Qualen Rd, York. NW corner of PP Loc. 28442, 19 August 2005, *F. & J. Hort* 2582 (CANB, PERTH); Helena River, Ridley Rd, York, 2.2 km W of Talbot Rd, 19 Aug. 2005, *F. & J. Hort* 2584 (NSW, PERTH); Brady State Forest, Watershed Rd, Beverley, 2.2 km S of Brookton Hwy, 20 Aug. 2005, *F. & J. Hort* 2585 (PERTH); Brady State Forest, Watershed Rd, Beverley, at apiary site, 3.4 km S of Brookton Hwy, then the minor track SSW for 200 m, 20 Aug. 2005, *F. & J. Hort* 2586 (PERTH);



Figure 1. *Conostephium hortiorum*. Scan of flowering branchlet from *F.* & *J. Hort* 2560. Scale bar = 1.5 cm.




Figure 2. *Conostephium hortiorum*. A – flowering branchlet; B – flower (unvouchered). Photographs by F. & J. Hort.

Wandoo National Park, Russell Block, Dobaderry Rd, Beverley; 4.1 km N of Edison Mill Rd, 350 m W along the minor sand track, 20 Aug. 2005, *F. & J. Hort* 2587 (PERTH); Wandoo National Park, survey site 4, 5 Oct. 2007, *M. Wheeler et al*. MW 291 (PERTH).

*Distribution and habitat*. A regional endemic of the eastern Darling Range in the Jarrah Forest bioregion (Department of the Environment, Water, Heritage and the Arts 2008), mostly between Great Southern Highway and Brookton Highway (Figure 3). Occurs on sandy flats, very occasionally over laterite, in low woodland usually dominated by *Banksia attenuata* or *Eucalyptus marginata*. Associated species include *Stirlingia latifolia*, *Allocasuarina humilis*, *Banksia sessilis* and *Hibbertia hypericoides*.

*Phenology*. The main flowering period is between July and September. The only fruiting specimen examined was collected in mid-November.

*Etymology*. The specific name honours Fred and Jean Hort, whose prolific and systematic collections from the eastern Darling Range have led to the recognition of many new species for that area. Although, in this case, they were not the first collectors of the species, their efforts in seeking new populations helped to confirm that it was taxonomically distinct and also, in large measure, established the extent of its geographical range.

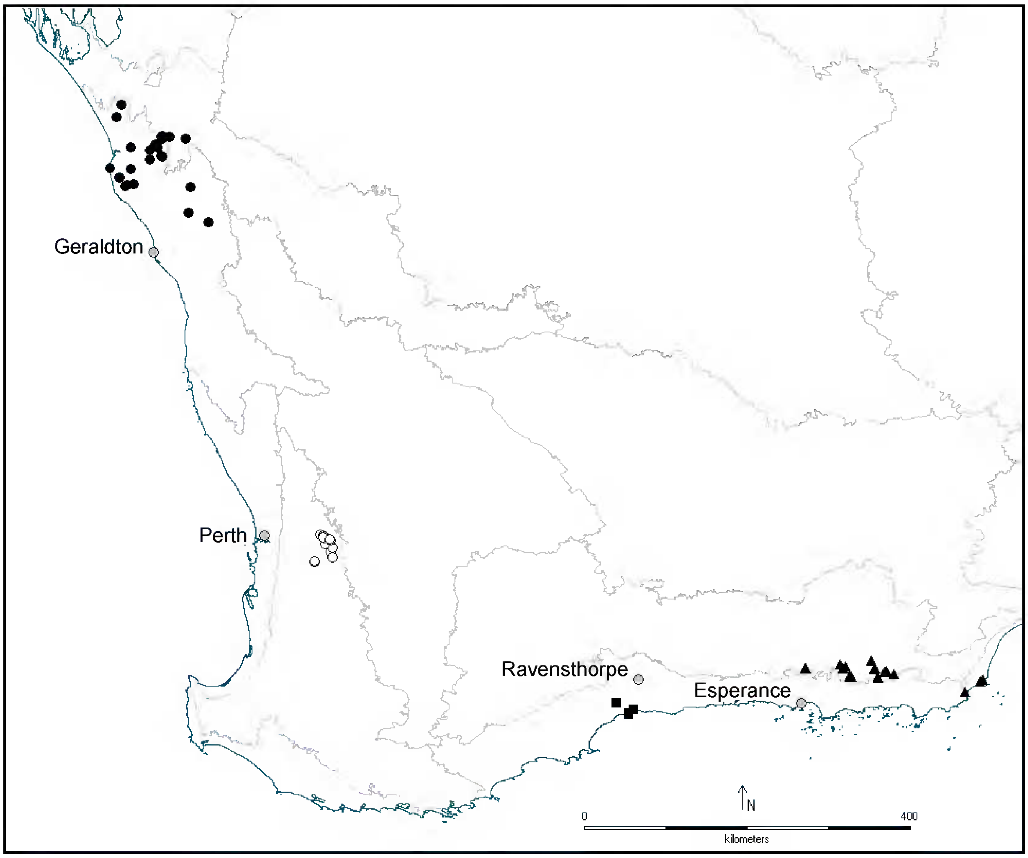



Figure 3. Distribution of *Conostephium hortiorum* (○), *C. laeve* (●), *C. papillosum* (▲) and *C. prolatum* (■) in Western Australia.

*Conservation status*. Although it does not currently fit the criteria for inclusion on the Department of Parks and Wildlife's (formerly the Department of Environment and Conservation's) *Threatened and Priority Flora list for Western Australia*, because of its restricted distribution, it is recommended that the status of this species be re-examined on an occasional basis.

*Affinities*. *Conostephium hortiorum* has been hitherto confused with *C. pendulum*, one of three species with which it shares several significant features (refer to the *Affinities* heading under *C. prolatum* Hislop for the detail of these shared characters). Critical differences between the two are the lack of hair tufts at the base of the corolla in *C. hortiorum*, the shorter inflorescence axes (2.8–5.2 mm long, usually <5 mm, in *C. hortiorum* compared to 5.4–10.2, usually >6 mm in *C. pendulum*) and longer corolla lobes (1.2–2.2 mm long, *cf.* 0.3–1.2 mm in *C. pendulum*). In addition a couple of vegetative characters also help to distinguish between the two. The branchlet indumentum of *C. pendulum* is essentially monomorphic with hairs to *c.* 0.2 mm long, whereas that of *C. hortiorum* is of mixed lengths and includes longer hairs (from *c.* 0.5–1.2 mm long), especially about the nodes. Relative to *C. pendulum* the new species also tends to have narrower leaves (most collections of *C. pendulum* have at least some leaves wider than the 3.6 mm upper limit recorded for *C. hortiorum*), with finer mucros and usually obviously ciliate margins (glabrous to minutely ciliolate in *C. pendulum*).

*Notes*. The description of the fruit given in the text above is based on a single collection and therefore cannot be regarded as definitive.

An anomalous collection (i.e. *M. Hislop* 3514) made from south of Wongan Hills has similarities to both *C. hortiorum* and *C. pendulum*. It has the branchlet indumentum, shorter inflorescence axes, and glabrous corolla bases of *C. hortiorum* in combination with the short corolla lobes of *C. pendulum*. Its most remarkable feature however is the presence of dense tufts of hair about the anther bases which obscure the filaments. The locality is disjunct for both species and the specimen may represent an undescribed taxon.

**Conostephium laeve** Hislop, *sp. nov.*

*Typus*: Binnu Road East, 4.7 km east of Balla Whelarra Road, north-east of Northampton, Western Australia, 7 June 2005, *M. Hislop* 3450 (*holo*: PERTH 07011547; *iso*: CANB, MEL, NSW).

Compact, well-developed *shrubs* to *c.* 1.5 m high and 1.5 m wide, multi-stemmed at or just above ground level, fire-resistance of rootstock not known. Young *branchlets* with a sparse to moderately dense indumentum of patent hairs to *c.* 0.3 mm long but usually less. *Leaves* antrorse, usually steeply so, narrowly elliptic or narrowly obovate, less often more broadly so, 5.5–18 mm long, 2.0–5.5 mm wide; apex obtuse to acute with a blunt callus tip; base attenuate to cuneate; petiole well-defined, cream-coloured to pale brown 0.5–1.8 mm long, sparsely to moderately hairy throughout or occasionally ± glabrous; lamina 0.20–0.35 mm thick, usually adaxially concave or flat, occasionally convex, longitudinal axis straight to gently incurved; surfaces slightly discolorous; adaxial surface shiny, usually glabrous, occasionally sparsely hairy at least towards the base, venation either not evident or manifesting as a few sunken lines; abaxial surface somewhat paler, shiny or not, with 5–7 primary veins, these usually raised with narrow to broad grooves between, occasionally the veins ± flat, the midrib not differentiated, usually sparsely to moderately hairy, occasionally glabrous; margins glabrous to coarsely ciliolate with hairs to *c.* 0.1 mm long. *Inflorescence* pendulous or sub-pendulous; axis (4.5–)5.6–9.5 mm long, sparsely to moderately hairy, the surface usually clearly visible between the bracts, very occasionally ± glabrous. *Axis bracts* 8–13, grading upwards between broadly ovate and

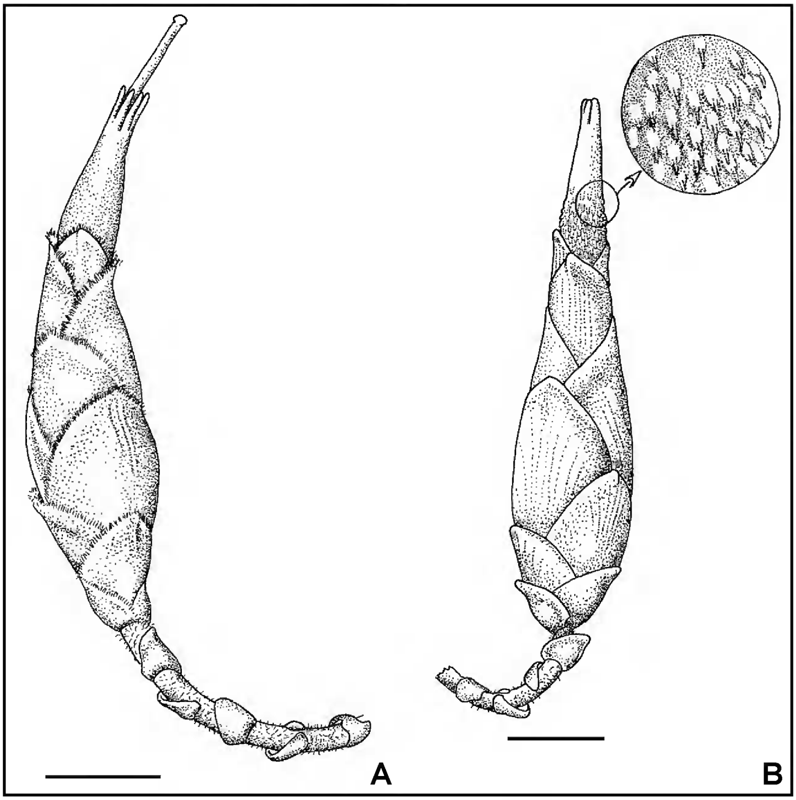



Figure 4. *Conostephium* flowers. A – *C. laeve*; B – *C. preissii*. Scale bars = 2 mm. Drawn by Skye Coffey from *M. Hislop* 3781 (A), *G.J. Keighery* 11189 (B).

ovate, the two uppermost, 1.7–3.0 mm long, 1.2–2.0 mm wide. *Floral bracts* 0–3, ovate, 2.8–3.9 mm long, 2.0–2.6 mm wide, obtuse, ± scarious throughout. *Bracteoles* ovate, 3.2–5.2 mm long, 2.0–2.7 mm wide, obtuse, abaxial surface glabrous or shortly hairy, cream- to straw-coloured, multi-veined and striate, ± scarious throughout; adaxial surface glabrous; margins minutely ciliolate. *Sepals* ovate to narrowly ovate, 4.8–7.3 mm long, 1.8–3.4 mm wide, the outer usually obtuse, the inner often mucronate or occasionally acute; abaxial surface glabrous to distinctly hairy, cream- to straw-coloured, sometimes flushed pale pink in the basal half, multi-veined and striate, ± scarious throughout; adaxial surface glabrous; margins ciliate with hairs to *c*. 0.4 mm long. *Corolla tube* actinomorphic or almost so, usually narrowly conical, less often ± cylindrical for the lower 2/3, 6.8–9.5 mm long, 1.7–2.5 mm wide, exposed portion pink, long-persistent on maturing fruit; external surface appressed-hairy in the lower 1/2–2/3, glabrous above, ± smooth; internal surface densely hairy in the upper half, more sparsely so below, the indumentum a mixture of antrorse and retrorse hairs. *Corolla lobes* erect to spreading, pink, 0.3–1.0 mm long, 0.2–0.3 mm wide at base, internal surface glabrous. *Anthers* 2.4–3.6 mm long, the lobes 1/8–1/4 the length of the anthers. *Filaments* 1.0–1.8 mm long, 0.4–0.5 mm wide, distinctly flattened, glabrous or occasionally sparsely hairy on the inner surface, the connective scarcely thickened, pale brown, attached 1/3–1/2 above anther base, adnate to tube 1.0–1.6 mm above the base. *Ovary* ovoid, 1.1–1.4 mm long, 0.6–1.0 mm wide, glabrous or sparsely hairy in the upper half, 2- or 3(4)-locular. *Style* 6.9–9.6 mm long, densely hairy in the lower 1/2–2/3 (hairs to 0.5 mm long); *nectary* apparently absent or vestigial and <0.1 mm long. *Fruit* ovoid, 8.2–10.2 mm long and 5.0–5.8 mm wide, apex conical, the surface rugose, particularly towards the apex; endocarp ± smooth. (Figures 4A, 5)



Figure 5. *Conostephium laeve*. Scan of flowering branchlet from *M. Hislop* 3781. Scale bar = 1.5 cm.

*Diagnostic characters*. Distinguished by the following combination of features: leaves usually flat to adaxially concave; inflorescence bracts 8–13; sepals prominently ciliate; exposed portion of corolla tube pink, more or less smooth; the only species occurring north of Geraldton.

*Other specimens examined*. WESTERN AUSTRALIA: Kalbarri National Park, 20 July 1967, *A.M. Ashby* 2161 (PERTH); 8 miles [approx. 12.9 km] N of Eurardy; 206 miles [*c*. 331.4 km] SSE of Carnarvon on North West Coastal Hwy, 21 Aug. 1965, *A.C. Beauglehole* 11868 (CANB, NSW, NY, PERTH); firebreak, 10 km S of Junga Dam, Kalbarri National Park, 19 Sep. 1993, *D. & B. Bellairs* 1727 (PERTH); Cooloomia Nature Reserve [now Zuytdorp Nature Reserve], 3.4 km W of intersection of main tracks to Nerren Nerren and Hamelin Station, towards the N in SW tongue of reserve, 29 Aug. 1991, *A.H. Burbidge* 4561 (PERTH); East Yuna Reserve, 1 June 1966, *A.C. Burns* 1 (PERTH); 7.9 km E of North West Coastal Hwy along road CS6 R25, 24 May 1994, *R.J. Cranfield* 9213 (CANB, PERTH); Kalbarri National Park, 18 Aug. 1994, *R.J. Cranfield* 9334 (PERTH); Binnu West Rd, 31.4 km from North West Coastal Hwy, 9 July 1997, *R. Davis* 3665 (PERTH); 10 km E along South Binnu Rd from Grey Rd intersection to Binnu, 7 Sep. 1997, *S. Donaldson* 1509 *& G. Flowers* (CANB, PERTH); North West Coastal Hwy, 24 miles [*c*. 38.6 km] N of the Murchison River Bridge, 6 Sep. 1966, *R. Filson* 8602 (MEL, PERTH); 9 miles [*c*. 14.5 km] N of Murchison River on North West Coastal Hwy, 6 Sep. 1966, *A.S. George* 7880 (CANB, PERTH); lay by off North West Coastal Hwy, 12.2 km N of Eurardy entrance, 8 June 2005, *M. Hislop* 3463 (CANB, NSW, PERTH); Eurardy Station along W boundary track 400 m S of the southern

of 2 diagonal intersecting tracks, 9 June 2005, *M. Hislop* 3467 (CANB, MEL, PERTH); Erriary Rd West, 10.5 km W of Yerina Springs Rd, S of Kalbarri, 24 July 2008, *M. Hislop* 3781 (CANB, PERTH); 13 km WSW of Eurardy Homestead, 25 Aug. 1999, *T.F. Houston* TFH 1012-4 (PERTH); 42.6 km W along State Barrier Access (S of fence), W from North West Coastal Hwy, 10 Apr. 1994, *G.J. Keighery & N. Gibson* 2017 (PERTH); 47 km SE of Kalbarri on Binnu Rd West, *c.* 4 km W of Yerina Springs Rd, *c.* 400 m to S of Binnu Rd West, 4 Aug. 1995, *T.R. Lally* 650 (PERTH); 39.7 km N of Murchison River on North West Coastal Hwy, 4 Sep. 1979, *J.M. Powell* 1386 (AK, CANB, K, L, MEL, NSW, PERTH).

*Distribution and habitat*. Mostly occurs in the northern part of the Geraldton Sandplains bioregion (Department of the Environment, Water, Heritage and the Arts 2008) with a few records from the far west of the adjoining Yalgoo bioregion; from Zuytdorp Nature Reserve in the north, through Kalbarri National Park to the Binnu area in the south, and with an apparent outlying population to the south-east at East Yuna Nature Reserve (Figure 3). Grows on yellow or white sandplain in the understorey of low *Banksia* woodland, or as a component of shrubland or heath.

*Phenology*. Flowers have been recorded from April to September but with a peak between May and July. Fruiting specimens have been collected between July and September but fruit is likely to be present at least until the end of October.

*Etymology*. From the Latin *laevis* (smooth), a reference to the more or less smooth upper corolla tube that is a major distinguishing character separating the new species from the similar *C. preissii*.

*Conservation status*. *Conostephium laeve* is a regional endemic that is often locally common in its preferred habitat. No conservation coding is recommended here.

*Affinities*. This species has previously been confused with the widespread *C. preissii*, the two differing most importantly in the surface texture and hair distribution of the external corolla. *C. laeve* has a corolla tube indumentum which extends from 1/2–2/3 above the base and with the surface beneath the hairs more or less smooth (Figure 4A). In *C. preissii* by contrast the hairs extend for at least 3/4 the length of the tube and are manifestly tubercle-based in the upper half (Figure 4B). Note however that in both species the basal 1.5–2 mm may be more or less glabrous. The uppermost tubercles tend to be more conspicuous because they are often not hair-tipped, and these are generally visible on the exposed portion above the sepals. Their presence/absence provides the easiest means of distinguishing between the two species. Two other characters were found to be diagnostic, although in both cases there is limited overlap between the species. *Conostephium laeve* generally has more inflorescence axis bracts (8–13, usually >8, *cf.* 6–9, usually 8 or less, in *C. preissii*) and leaves which are mostly adaxially concave, much less often convex, or a mixture of flat and convex. The leaves of *C. preissii* are almost always convex or a mixture of flat and convex. The very few specimens which have manifestly concave leaves are either from the far north of that species range (e.g. *M. Hislop & F. Obbens* MH 3612) or are of a pruinose variant which occurs in southern inland parts of the Geraldton Sandplains (e.g. *G.J. Keighery & B.J. Keighery* 480). The sepal margins provide a further distinction between the species. Whereas those of *C. preissii* are either glabrous throughout or minutely ciliolate about the apex only, in *C. laeve* the margins are manifestly ciliate for most of their length, with hairs 0.1–0.4 mm long. Although the most common ovary locule number in the new species is two, collections from the southern part of Kalbarri National Park consistently have a 3(4)-locular ovary, a character shared with *C. preissii* (which apparently never has two). The higher locule number in this variant generally correlates with the presence of convex leaves. Although the other distinguishing characters discussed above are those of *C. laeve*, the somewhat intermediate morphology of this southern variant suggests that it may have a closer relationship with *C. preissii*.

The two species have parapatric distributions. The southernmost and apparently outlying population of *C. laeve* at East Yuna Nature Reserve is about 100 km to the north-east of the most northerly known occurrence of *C. preissii* at Yardanogo Nature Reserve, south-east of Dongara. The main centre of distribution for *C. laeve* however, begins about 150 km north of the latter locality.

**Conostephium papillosum** Hislop, *sp. nov.*

*Typus*: Parmango Road, 27.8 km north-east of Fisheries Road (Reserve 32127), north-east of Condingup, Western Australia, 26 July 2006, *M. Hislop* 3626 (*holo*: PERTH 07709153; *iso*: CANB, K, MEL, NSW).

Compact, well-developed *shrubs* to *c.* 1.5 m high and 1.5 m wide, multi-stemmed at or just above ground level, fire-resistance of rootstock not known. Young *branchlets* with a sparse to moderately dense indumentum of short, patent hairs to *c.* 0.1 mm long. *Leaves* antrorse, usually steeply so, narrowly obovate or narrowly elliptic, less often narrowly obtriangular or oblong where the leaf margins are strongly recurved, 3.8–8.0 mm long, 1.0–2.3 mm wide; apex acute or subacute with a blunt callus point to 0.1 mm; base cuneate or attenuate; petiole well-defined, cream-coloured to yellow-brown, 0.4–1.2 mm long, either sparsely hairy throughout or the abaxial surface glabrous; lamina 0.35–0.45 mm thick, usually adaxially convex, with the margins varying from slightly recurved to revolute, occasionally flat, longitudinal axis straight to gently incurved; surfaces discolorous; adaxial surface shiny, glabrous, often faintly verrucose, venation not evident; abaxial surface paler, shiny or not, with 5 raised primary veins and usually ± tightly closed grooves between, the midrib slightly wider than the others towards the apex, glabrous across most of the surface except for short hairs that are often visible within the grooves; margins thick, glabrous for most of their length, becoming coarsely ciliolate towards the apex with hairs to *c.* 0.1 mm long. *Inflorescence* pendulous or sub-pendulous; axis 1.5–2.6 mm long, densely hairy although surface mostly obscured by imbricate bracts. *Axis bracts* 7–9, grading upwards from depressed-ovate to ovate, the two uppermost, 1.3–2.2 mm long, 1.0–1.5 mm wide. *Floral bracts* 0 or 1, broadly ovate, 2.2–2.4 mm long, 2.0–2.2 mm wide, obtuse. *Bracteoles* ovate to ± orbicular, 2.1–3.4 mm long, 1.5–2.3 mm wide, obtuse; abaxial surface with a sparse, usually appressed indumentum, at least in the upper half, straw-coloured, multi-veined and faintly striate, becoming scarious towards the margins; adaxial surface glabrous; margins densely ciliate. *Sepals* ovate to narrowly ovate, 3.3–6.0 mm long, 1.8–2.6 mm wide, grading from obtuse in the outer sepals to mucronate and sometimes ± acute in the inner; abaxial surface with a sparse to moderately dense indumentum at least in the upper half, very occasionally ± glabrous, straw-coloured, multi-veined and faintly striate, becoming scarious towards the margins; adaxial surface glabrous; margins ciliate with hairs to 0.3 mm long. *Corolla tube* slightly to distinctly zygomorphic, essentially fusiform with the widest part at, a little below or a little above the middle, 5.7–9.0 mm long, 1.8–2.3 mm wide, exposed portion dark purple, long-persistent on maturing fruit; external surface hairy in the lower 1/2–2/3, the indumentum appressed in the upper portion of this zone, ± spreading below, papillose in the upper half (except immediately below the lobes), smooth below; internal surface hairy throughout, except for restricted glabrous zones immediately below the lobes and at the very base, the indumentum long and spreading above and below the anthers, antrorse-appressed behind the anthers. *Corolla lobes* erect to ± spreading, white or cream, 0.4–0.8 mm long, 0.2–0.3 mm wide, internal surface glabrous. *Anthers* 1.8–3.0 mm long, the lobes 1/3–1/2 the length of the anthers. *Filaments* 0.8–1.4 mm long, 0.2–0.3 mm wide, dorsiventrally compressed, usually glabrous or with a few hairs close to the base, the connective not thickened, attached 1/4–1/3 above anther base, adnate to tube a little above to a little below the middle. *Ovary* ellipsoid to ± globose, 1.0–1.4 mm long, 0.9–1.3 mm wide, usually glabrous, or with a few hairs immediately below the style base, occasionally densely hairy in the upper half, 3- or 4(5)-locular. *Style* 5.8–9.2 mm long, usually glabrous, occasionally hairy in the lower 2/3; *nectary* apparently absent. *Fruit* broadly ovoid, *c.* 4 mm long and 3.5 mm wide (refer comment under *Notes* below), apex obtuse, the surface finely reticulate throughout; endocarp ± smooth. (Figures 6A, 7)

*Diagnostic characters*. Distinguished by the following character combination: exposed portion of corolla tube dark purple, hairy, papillose; corolla long-persistent on maturing fruit; anthers lacking a thickened connective; drupe endocarp smooth.

*Other specimens examined*. WESTERN AUSTRALIA: 4.6 km NW along Kau Rock Rd from junction of Coolinup Rd, Esperance, on dunes at S end of salt lake, 28 Apr. 2006, *E.D. Adams* 510406 (PERTH); Mt Beaumont land release, stage 2, 31 Dec. 1982, *E.M. Bennett* BLR 24 (PERTH); 4 km S of Norwood Rd on Styles Rd [SE of Grass Patch], 22 Sep. 1992, *G.F. Craig* 2179 (PERTH); 1 km N of Neridup Swamp [NE of Condingup], 19 Aug. 1995, *R.J. Cranfield* 10173 (CANB, PERTH); SW of Mt Ney, 9 Aug. 1980, *A.S. George* 15919 (PERTH); NE of Point Lorenzen, *c*. 12 km past fisherman's shack at Israelite Bay, 19 May 2002, *M. Hislop & F. Hort* MH 2633 (PERTH); Muntz Rd, 1.9 km N of Shearer Rd, NE of Condingup, 26 July 2006, *M. Hislop* 3628 (CANB, PERTH); Reserve 32129, Karl Berg Rd, 8.5 km SW of Beaumont Rd, NE of Condingup, 16 Aug. 2007, *M. Hislop* 3724 (PERTH); 2.4 km SSE of Mt Ney Rd on Kau Rock Rd [N of Condingup], 20 Sep. 1985, *J. Nunn* 156 (CANB, PERTH); *c*. 2–3 km NE along track from Israelite Bay, 29 July 1986, *J.M. Powell* 2203 (HO, NSW, PERTH); track to Point Malcolm, 4.5 km S from junction with Israelite Bay track, 29 July 1986, *J.M. Powell* 2216 (CANB, NSW, PERTH); 7.6 km SW on Karl Berg Rd from junction with Beaumont Rd, Esperance area, 5 Sep. 1986, *J.M. Powell* 2885 (NSW, PERTH); *c*. 100 km E of Esperance and *c*. 51 km N of the coast, 1 Oct. 1970, *P.G. Wilson* 10041 (CANB, MEL, PERTH).

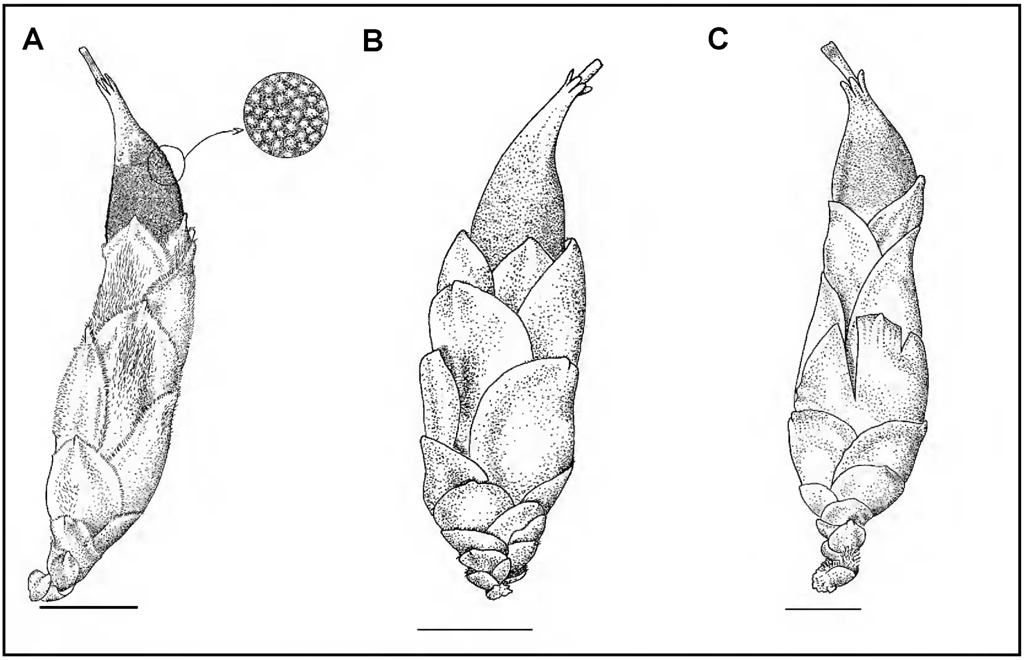



Figure 6. *Conostephium* flowers. A – *C. papillosum*; B – *C. roei*; C – *C. prolatum*. Scale bars = 2 mm. Drawn by Skye Coffey from *M. Hislop* 3626 (A), *M. Hislop* 4130 (B), *M. Hislop* 4139 (C).



Figure 7. *Conostephium papillosum*. Scan of flowering branchlet from *M. Hislop* 3626. Scale bar = 1.5 cm.

*Distribution and habitat*. Found from *c*. 50 km north-east of Esperance to the Israelite Bay area (Figure 3) in the Mallee and Esperance Plains bioregions (Department of the Environment, Water, Heritage and the Arts 2008). It generally occurs well away from the coast in light loam or sandy soils, usually low in the landscape and sometimes around saline depressions. In the eastern part of its range however, around Israelite Bay, it grows quite close to the coast. Associated vegetation is usually mallee woodland.

*Phenology*. Flowering specimens have been collected between May and October although peak flowering is probably between June and August. The only specimen with mature fruit was collected in mid-August but presumably fruit is likely to be present on plants at least until October.

*Etymology*. From the Latin *papillosus* (papillate), a reference to the texture of the upper corolla tube which represents a significant difference between the new species and *C. roei*.

*Conservation status*. This species is locally common and known to be represented in several national parks and nature reserves. No conservation coding is recommended here.

*Affinities*. Although *C. papillosum* has previously been confused with *C. roei* there are many differences between them and it seems unlikely that their relationship is a particularly close one. The most significant of these differences are as follows: in *C. papillosum* the upper portion of the outer corolla tube is papillose (smooth in *C. roei*) (Figure 6A, B), the drupe endocarp is smooth (*cf.* endocarp with prominent longitudinal ribs), the corolla is long-persistent on maturing fruit (*cf.* shed soon after anthesis), the nectary is apparently absent (*cf.* clearly present, to 0.2 mm long) and the anthers are without a thickened connective (*cf.* with a dark brown, prominently thickened connective).

*Notes*. The description of the fruit given in the text above is based on a single collection and therefore cannot be regarded as definitive.

Populations in the Israelite Bay area are disjunct from the species' main centre of distribution further to the west. Collections made in this area have flowers with a well-developed indumentum on the style and upper half of the ovary which more or less obscures the surface. By comparison, in the typical form the ovary is either glabrous or has a restricted zone of rather sparse hairs about the style base and the style itself is almost always totally glabrous. These characters have taxonomic significance elsewhere in *Conostephium* and on this basis there may be grounds for the recognition of a second taxon. However, the few available specimens of the eastern form, the fact that some hairs may be present on the ovary of the typical form (although relatively reduced in extent) together with the presence of one specimen (i.e. *G.F. Craig* 2179) with a hairy style at the western end of the species' range, all suggests that further collecting is needed before this question can be properly addressed.

This species is sympatric with the Esperance variant of *C. drummondii* (as discussed below) over much of its range and the two sometimes co-occur in the same habitat.

**Conostephium prolatum** Hislop, *sp. nov.*

*Typus*: southern Fitzgerald River National Park, Western Australia [precise locality withheld for conservation reasons], Western Australia, 29 August 2011, *M. Hislop* 4139 (*holo*: PERTH 08318026; *iso*: CANB, K, MEL, NSW).

Erect, well-developed *shrubs* to 1m high and 1 m wide, branching from close to the base but with a fire-sensitive rootstock. Young *branchlets* with a sparse to moderately dense indumentum of short hairs to *c.* 0.1 mm long. *Leaves* variably antrorse, narrowly obovate or narrowly obtriangular, occasionally linear, 10–22 mm long, 1.8–4.2 mm wide; apex long-mucronate, the mucro 0.5–1.0 mm long, ± straight, brown, coarsely pungent; base cuneate or attenuate; petiole well-defined, cream-coloured to pale brown, 0.8–1.3 mm long, hairy on the adaxial surface and sometimes also the margins, glabrous on the abaxial surface; lamina 0.15–0.25 mm thick, adaxially convex, the margins varying from slightly recurved to revolute, longitudinal axis straight; surfaces discolorous; adaxial surface shiny, glabrous, faintly verrucose, venation not evident; abaxial surface paler with 5–9 raised, primary veins, with narrow to quite broad grooves between, the midrib not differentiated from the others, glabrous throughout or with short sparse hairs in the grooves; margins glabrous or coarsely and very minutely ciliolate. *Inflorescence* pendulous or sub-pendulous; axis 2.3–3.1 mm long, hairy, in large part obscured by the bracts. *Axis bracts* 6–10, depressed ovate, the two uppermost, 1.7–2.2 mm long, 1.7–2.3 mm wide. *Floral bracts* 1–4, depressed ovate to broadly ovate, 2.7–4.4 mm long, 2.5–3.5 mm wide, obtuse, obscurely mucronate. *Bracteoles* broadly ovate to ovate, 4.0–5.6 mm long, 2.8–3.5 mm wide, obtuse, obscurely mucronate; abaxial surface glabrous, cream- to straw-coloured, multi-veined, ± smooth, becoming scarious towards the margins; adaxial surface glabrous; margins minutely ciliolate. *Sepals* ovate to narrowly ovate 4.8–7.5 mm long, 2.2–3.5 mm wide, the outer obtuse and obscurely mucronate, the innermost acute or subacute; abaxial surface glabrous, cream- to straw-coloured, multi veined, ± smooth, becoming scarious towards the margins; adaxial surface glabrous; margins minutely ciliolate with hairs <0.1 mm long. *Corolla tube* markedly zygomorphic, essentially fusiform, with the widest part a little above the middle, 7.5–9.5 mm long, 2.7–4.0 mm wide, exposed portion dark purple, shed soon after anthesis; external surface glabrous and smooth throughout; internal surface moderately hairy from the orifice to the base of the bulge, the indumentum shallowly retrorse above the anthers and a mixture of retrorse-appressed and antrorse-appressed behind the anthers, glabrous below the bulge. *Corolla lobes* erect to ± spreading, white, 0.4–0.6 mm long, 0.3–0.4 mm wide at base, internal surface glabrous throughout or with a few hairs at the base. *Anthers* 3.2–4.0 mm long, the lobes 1/4–1/3 the length of the anthers. *Filaments* 0.7–1.0 mm long, 0.5–0.6 mm wide, glabrous, the connective abruptly and prominently thickened, dark brown, attached *c.* 1/2 above anther base,

adnate to tube a little above the middle. *Ovary* ovoid or broadly ovoid, 1.0–1.4 mm long, 0.8–1.0 mm wide, glabrous, 4- or 5-locular. *Style* 8.0–10.8 mm long, glabrous; *nectary* annular, with an irregular margin, 0.2–0.3 mm long. *Fruit* ovoid or broadly ovoid, 4.5–5.8 mm long, 4.2–4.6 mm long, apex obtuse, the surface rugose; endocarp ± smooth. (Figures 6C, 8)

*Diagnostic characters*. Distinguished by the following character combination: leaves 10–22 mm long with mucros 0.5–1.0 mm long; inflorescence axes 2.3–3.1 mm long; exposed portion of corolla tube dark purple, smooth; anthers with prominently thickened, dark brown connectives; drupe endocarp smooth.

*Other specimens examined*. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 3 Sep. 1986, *A.R. Chapman* 535 (CANB, K, MEL, NSW, PERTH); 30 Aug. 2001, *M. Hislop* 2283 (PERTH); 22 Oct. 2011, *M. Hislop* 4154 (CANB); 22 Oct. 2011, *M. Hislop* 4155 (CANB, NSW); 1 Oct. 1970, *B.R. Maslin* 920 (PERTH).

*Distribution and habitat*. Apparently restricted to a small area in the south-east of Fitzgerald River National Park (Figure 3) in the Esperance Plains bioregion (Department of the Environment, Water, Heritage and the Arts 2008). At the type locality it is growing in shallow sand over quartzite, as a component of sub-coastal heath. Associated species include *Banksia heliantha*, *Agonis baxteri*, *Calothamnus pinifolius* and *Taxandria conspicua*. In this area it occurs both in more or less flat coastal plain and on a neighbouring quartzite ridge. It has also been recorded on deeper sandy soils away from surface quartzite and from ‘brown clay’ in close proximity to a creek.

*Phenology*. The main flowering period is likely to be between August and October.



Figure 8. *Conostephium prolatum*. Scan of flowering branchlet from *M. Hislop* 4139. Scale bar = 1.5 cm.

*Etymology*. From the Latin *prolatus* (lengthened, extended), a reference to the longer leaves with longer mucros, relative to the similar species, *C. roei*.

*Conservation status*. To be listed as Priority Two under the Department of Parks and Wildlife's Conservation Codes for Western Australian Flora (M. Smith pers. comm.). A short-range endemic of Fitzgerald River National Park where it is currently known only from four populations. It is common at the type locality where there are at least many hundreds of plants and possibly as many as several thousand. The given localities of two of the other populations are rather imprecise and require verification.

*Affinities*. *Conostephium prolatum* has a number of significant features in common with *C. pendulum*, *C. roei* and *C. hortiorum* which suggest a close relationship. All have prominently thickened, dark brown anther connectives, corollas which are shed soon after anthesis, a glabrous gynoecium, more or less smooth corolla tubes with the visible portions coloured dark purple, and relatively well-developed nectaries, although still very reduced in comparison to those of other genera. In addition, the flowers of the first three taxa listed above, share the same distinctive fragrance (the status of *C. hortiorum* in this regard is unknown) which appears to be absent from those of the other members of the genus. Of this group *C. prolatum* is probably most likely to be confused with *C. roei* which occurs to the north of Fitzgerald River National Park. The two species can be distinguished in the following ways: *C. prolatum* has longer leaves, 10–22 mm long, with longer, finer mucros, 0.5–1.0 mm long (in *C. roei* the leaves are 4.5–9.5 mm long and the mucros 0.2–0.3 mm long), longer inflorescence axes, 2.3–3.1 mm long (*cf.* 0.9–2.0 mm long) and in the detail of the apical part of the corolla (Figure 6B, C). Whereas *C. roei* has a corolla tube which is very narrowly attenuate below the orifice (tube width immediately below the lobes, 0.3–0.4 mm wide), in *C. prolatum* the tube is significantly broader in this region (0.5–0.8 mm wide). In addition the internal surface of the tube is glabrous for at least 0.5 mm below the lobes in *C. roei* and the uppermost hairs are strongly retrorse or antrorse. By contrast in *C. prolatum* all of the upper tube, often including the lobe bases, has an essentially spreading indumentum of patent and shallowly retrorse/antrorse hairs. The fruiting endocarp provides another important difference between the two. Uniquely in *Conostephium*, the endocarp of *C. roei* has prominent longitudinal ridges, whereas in *C. prolatum* it is smooth.

## Lectotypifications and notes on other species of *Conostephium*

**Conostephium drummondii** (Stschegl.) C.A.Gardner, *Enum. Pl. Austral. Occ.* 105 (1931). *Conostephiopsis drummondii* Stschegl., *Bull. Soc. Imp. Naturalistes Moscou* 32 (1): 6 (1859). *Type*: 'Nova Hollandia' [Western Australia], 1847–1849, *J. Drummond* 5: 299 (*holo*: KW *n.v.*; *iso*: K 000356715!, K 000356151!).

*Styphelia conantha* F.Muell., *Fragm.* 6:30 (1867). *Conostephium planifolium* F.Muell. ex Benth., *Fl. Austral.* 4: 161 (1868), *nom. illeg. Type*: 'In collibus sabulosis inter promontaria Cape Malcolm et Point Culver' [Western Australia], *s. dat.*, *G. Maxwell s.n.* (MEL 2183647!).

*Distribution and habitat*. This species is widely distributed in a variety of habitats close to the south coast and in central southern parts of Western Australia mostly in the Esperance and Mallee bioregions (Department of the Environment, Water, Heritage and the Arts 2008), also with a few records from the south of the Coolgardie bioregion.

*Conservation status*. None of the variants described below appear to be of conservation concern and all are represented in national parks and/or nature reserves.

*Notes*. *Conostephium drummondii* is the most variable species in the genus. In the course of this study a preliminary investigation into the pattern of variation across the species' range identified four morphotypes, but with apparent intermediates at least between some of these. Further research is required to establish whether any are worthy of taxonomic recognition. The type form occurs in Fitzgerald River National Park and east at least as far as the Jerdacuttup area. It is characterised by its relatively long (i.e. the longer leaves between *c*. 8–14 mm long) and thin leaves with well-developed apical mucros. Disjunct from these populations, in an area north-east of Esperance, there occurs a second variant with a generally similar morphology. It differs in having usually longer mucros and longer hairs on the inner corolla tube below the anthers. An eastern variant from sub-coastal sand dunes east of Israelite Bay has the inner corolla tube hair character of the latter but with thicker and rather smaller leaves than either the typical or Esperance variants. The morphology of the type of *Styphelia conantha* best matches the Esperance variant although the given locality places it within the distribution of the eastern variant. All of the more inland collections are of a fourth variant characterised by its relatively small, thick leaves which terminate in a blunt callus rather than a well-developed mucro.

**Conostephium pendulum** Benth. in S.F.L.Endlicher, E.Fenzl, G.Bentham, & H.W.Schott, *Enum. Pl.*: 76 (1837). *Styphelia conostephium* F.Muell., *Fragm*. 6: 40 (1867). *Type citation*: 'King George Sound et Swan River. (Hügel)'. *Type*: 'King George Sound' [but probably the Perth region, Western Australia, 27 November–19 December 1833], *C.A.A.F. von Hügel s.n.* (*lecto*, here designated: W 0023005, right-hand individual, image seen). Excluded *syntypes*: 'King George Sound' [but probably the Perth Region, Western Australia, 27 November–19 December 1833], *C.A.A.F. von Hügel s.n.* (W 0023005, left-hand individual), = *C. preissii*. 'Swan River' [Western Australia, 27 November–19 December 1833], *C.A.A.F. von Hügel s.n.* (W 0023004, both specimens, image seen), = *C. preissii*.

*Distribution and habitat*. Occurs in sandy soils from the Eneabba area to Margaret River in the Geraldton Sandplains, Swan Coastal Plain and Jarrah Forest bioregions (Department of the Environment, Water, Heritage and the Arts 2008). It is mostly found on the coastal plain, but also occurs on the Dandaragan Plateau in the north and Whicher Range in the south. Commonly associated with *Banksia* woodland, but also in heath, especially in the north of its range.

*Conservation status*. A common, widespread species.

*Notes*. *Conostephium pendulum* is a rather variable species. Plants from the Geraldton Sandplains, at the northern end of the species' range, tend to have larger flowers and leaves, with fewer flowers per branchlet, and therefore present a rather different aspect to the typical form. However, no consistent morphological disjunctions which might support the recognition of a segregate taxon were identified in the course of this study.

*Lectotypification*. As indicated in Bentham's protologue there are two syntypes of *C. pendulum* at the Natural History Museum in Vienna, both annotated in Bentham's hand. One is purportedly from King George Sound [the Albany area], the other from Swan River [the Perth area]. The Swan River syntype (W 0023004) comprises two specimens both of which are *C. preissii*, although probably from different plants — the left-hand one being in fruit and the right-hand in early bud. The King George Sound syntype (W 0023005) also consists of two specimens and again one of these is a sterile collection of *C. preissii*. The right-hand specimen on this sheet is flowering material of *C. pendulum* and is lectotypified above. In Bentham's generic description it is clear that he is referring to the flowers of *C. pendulum*, and not those of *C. preissii*, when he describes the presence of basal hair tufts and a 5-locular ovary (hair tufts are absent in *C. preissii* and the ovary is 3-locular). In most respects the species protologue is so generalised that it could be describing either species, but the reference to the glabrous, external

corolla tube (hairy in *C. preissii*) which is darkly coloured (rather than pale pink) again suggests *C. pendulum*. The two species frequently grow together around Perth but even in the absence of flowers or fruit can usually be reliably distinguished on the basis of a rather different foliar morphology.

The given locality for the lectotype is almost certainly an error. No species of *Conostephium* are known to occur anywhere near Albany whereas both *C. pendulum* and *C. preissii* are common around Perth.

**Conostephium preissii** Sond., in C.G.C.Lehmann, *Pl. Preiss*. 1(2): 304 (1845). *Conostephiopsis preissii* (Sond.) Stschegl., *Bull. Soc. Imp. Naturalistes Moscou* 32 (1): 6 (1859). *Styphelia preissii* (Sond.) F.Muell., *Fragm*. 6: 40 (1867). *Type citation*: 'In arenoso-umbrosis silvae haud longe ab urbe Freemantle, d. 13 Mart. 1839. Ad ripam fl. Canning-River, d. 4 Dec. 1839. In solo arenoso inter fruitices ad fluvium Cygnorum, d. 4 Febr. 1839. Herb. Preiss. No. 416' (*lecto*, here designated: MEL 2183439!, left-hand mounted individual). Excluded *syntypes*: locality statement as for lectotype, MEL 2183439!, right-hand mounted individual, fragment in envelope in right hand corner. In solo arenoso inter fruitices ad fluvium Cygnorum, d. 4 Febr. 1839. Herb. Preiss. No. 416 (LD 1076046, image seen; S 08-3546, image seen).

*Conostephium* sp. Salt Lake (J. Buegge D7), Western Australian Herbarium, in *FloraBase*, http://florabase.dec.wa.gov.au [accessed 10 October 2011].

*Distribution and habitat*. A widely distributed species of sandy soils in *Banksia* woodland and various heathland communities. Its main occurrence lies on the coastal plain from north of Eneabba to the Harvey area in the Geraldton Sandplains and Swan Coastal Plain bioregions (Department of the Environment, Water, Heritage and the Arts 2008). It is also distributed sporadically east of the Darling Scarp and extends well inland (Avon Wheatbelt, Mallee and Coolgardie bioregions), where it is restricted to the environs of salt lakes, often on gypsum dunes.

*Conservation status*. A common, widespread species.

*Notes*. The distribution of *C. preissii* is an unusual one in the flora of south-western Australia. It is a pattern that would frequently be indicative of taxonomic divergence. The inland variant of the species had previously been recognised by the author as a distinct taxon with the phrase name *Conostephium* sp. Salt Lake (J. Buegge D7). This variant always has a glaucous aspect with both leaf surfaces and branchlets consistently hairy. It also tends to be a larger shrub with mature plants growing up to 1.8 m in height. However, in the course of this study a detailed comparison between the floral morphology of the inland variant and the typical western form identified no consistent differences. And although the vegetative character combination, as described above, is always a feature of the salt lake variant it is also found, although much less commonly, in the typical form. There is therefore little morphological support for the continued taxonomic recognition of *C.* sp. Salt Lake. At the same time such an anomalous distribution suggests that a molecular study into infraspecific relationships within *C. preissii* would make an interesting subject for future research.

*Lectotypification*. Type material on MEL 2183439 is from Sonder's own herbarium. It consists of two mounted specimens and a third, smaller fragment in an attached envelope. The sheet is annotated only with the same citation given in the protologue and gives no indication of whether the three individual specimens are from the three different collecting localities given by the author, and if so, which specimen is associated with which locality. The nominated lectotype is the largest of these three specimens and the only one with flowers present.

**Conostephium roei** Benth. *Fl. Austral.* 4: 160 (1868). *Type*: 'In the interior' [of Western Australia], *s. dat.*, *J.S. Roe s.n.* (*holo*: K 000356150!).

*Distribution and habitat.* Restricted to the Mallee bioregion (Department of the Environment, Water, Heritage and the Arts 2008), from north-east of Ongerup in the west to just east of Lake Magenta and in a wide north–south band from a little south of Newdegate to the southern boundary of Lake Magenta Nature Reserve. Grows in deep sand or sandy loam soils, sometimes over laterite or in proximity to saline features.

*Conservation status.* Has a fairly restricted distribution but is locally common and represented in several nature reserves. No conservation coding is recommended here.

*Notes. Conostephium roei* is the only species in the genus with a longitudinally ridged endocarp. Other distinctive features are the longitudinally recurved corolla tube (the most conspicuously zygomorphic in the genus) and the very narrow upper portion of the tube (Figure 6B). Plants from populations growing in upland sites, with a lateritic substrate, tend to have broader leaves with flat or barely recurved margins. The typical variant has narrower leaves, usually with manifestly recurved margins, and is apparently always associated with sandy soils, low in the landscape.

A collection (*A. Coates* AC 4958) from a saline habitat near Lake Cobham (a little to the east of Lake Magenta) clearly has affinities with *C. roei*, but is anomalous in several ways and may represent an undescribed taxon. Although two-flowered inflorescences are otherwise very uncommon in all species of *Conostephium*, on this collection they are numerous. In addition the leaves, sepals and corolla are considerably larger than is normal for the species. The fact that the plant was collected in full flower in late March may also be significant. The usual flowering period for *C. roei* is between July and September.

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